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ELECTRIC SWITCH HAVING A MECHANISM WHICH LIMITS  
INCORRECT OPERATION

Background of the invention

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The present invention relates to an electric switch comprising a housing, a stationary median contact part and at least two stationary side contact parts, a contact element which is articulated on a support of  
10 the median contact part and which is capable of rocking from a stable median position to an unstable position on one or the other side of said median position, and an operating member articulated on the housing, which comprises a spring-loaded pusher rod and is capable of  
15 sliding in a recess of said operating member, the latter cooperating with the contact element in such a manner that said pusher rod tends to cause said element to return to its stable median position.

20 Description of the prior art

An electric switch of this type has already been described in patent application DE-OS 23 18 487. This is made up of a housing in which a rocking contact  
25 element mounted on a median contact part can pivot between two working positions. This contact part comprises two side plates connected by a median bar. These plates comprise vertical limit stops in the middle and two pairs of shoulders intended to carry the  
30 rocking contact element, which comprises laterally offset elongations for this purpose. At its point of articulation, it comprises a V-shaped trough in which rests the rounded end of a pusher rod. The latter slides in a tubular extension of the operating member  
35 and is pushed back by a spring. As a consequence, when said member occupies its median position, the rocking contact element is also located between its two working positions. If force is applied to the left-hand side of the operating member, the contact element pivots

leftwards and the right-hand contact is closed, so for example turning on the low speed of a two-speed fan motor in a motor vehicle. This element moreover continues to pivot until it reaches an end position. If  
5 force is applied to the other side of the operating member, it is the left-hand contact which is closed, for example turning on the high speed.

Furthermore, patent application DE-AS 12 95 048  
10 describes a push button switching device comprising a plurality of switching elements mounted in a trough-shaped frame. A slide which carries corresponding contact springs cooperates with each of these elements. This slide may be brought into two working positions  
15 against the action of a return spring thanks to the cooperation of a cardioid-shaped guide with an oscillating lever which carries a finger which slides in said guide. To this end, the latter comprises communicating grooves having different gradients and  
20 depths, in which the finger is guided when the slide moves, and which determine the two switching positions. A pivot articulates the oscillating lever on the slide. The large arm of said lever and its pivot are located outside the frame, such that said slide may be  
25 withdrawn forwards. In order for the finger, when in motion, to be able to follow the differences in level of the guide grooves, the lever, which is made of injection-molded plastics, must have a certain degree of resilience, so as always to press said finger  
30 against the bottom of these grooves. It is this resilient lever which is the essential element of this push button switching device.

The object of the invention is to improve an electric  
35 switch of the above-stated type such that, once the switching operation has started, the contact element is kept in the desired unstable position until the end of said switching and such that deliberate or

unintentional disconnection is prevented during this time.

#### Summary of the invention

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According to the invention, the switch comprises a switching bar which is connected by positive guide elements to the operating member so as to cause the contact element to pivot while said bar is moving from  
10 its median position to one or the other of its contact-making positions, depending on the direction of this movement.

The positive guiding advantageously makes it possible  
15 to keep the contact element in one of its unstable working positions. Deliberate or unintentional movement of this bar in the same direction or in the opposite direction does not immediately break the connection made in this unstable position. Return to the stable  
20 median position only occurs when the finger arrives at the upper or lower inversion sector of the guide curve, so ensuring that incorrect operation does not occur. It is furthermore advantageous for forcibly opening stuck or welded contacts.

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#### Brief description of the drawings

The invention will be described in greater detail with reference to the appended drawings, which are given by  
30 way of nonlimiting example and in which:

Figure 1 is a large scale, partially sectional view of a side elevation of an electric switch;

Figure 2 is an exploded perspective view of the switching system comprising an operating member and a  
35 switching bar;

Figure 3 is a plan view of the switching system; and

Figure 4 is a perspective view of said system.

#### Description of the preferred embodiments

A housing designated 1 in Figure 1 comprises a lower part 48, which is held in side walls 49. To this end, said lower part 46 comprises, over some of its  
5 periphery, a projecting flange 50, accommodated in corresponding grooves in said side walls. These latter walls are in two parts, held together, for example, by a snap-fit retaining device (not shown). As the housing 1 is open at the top, its lower part 48 comprises a  
10 drain opening 43, through which any liquid which has entered said housing, water for example, may leave again. To ensure that said liquid cannot flow into the switching system, the part 48 comprises a partition 44 on its inner face. Said partition moreover serves to  
15 protect the elements of said system by preventing a projecting end of a cable from coming into unexpected contact with them when it is soldered to terminals 51.

Apart from these two terminals 51, stationary median  
20 contact parts 2 and 2' and stationary side contact parts 3 and 4 are firmly connected to the lower part 48 of the housing. Their respective terminals 30, 31 and 52, 53 protrude below said part 48. A cable connecting the switch to an electronic circuit may be connected to  
25 these terminals by means of a plug (not shown). In addition to these median contact parts 2, 2' and lateral contact parts 3, 4, the switching system comprises contact elements 5 and an operating member 6. As shown in Figure 2, this member 6 is composed of two  
30 parts, a pivoting part 8 and an extension piece 7, for technical reasons relating to manufacture. These two parts are connected by a lug 46 of moderate length located in the middle and on either side of the latter by two shorter lugs 47. Said parts may be fastened  
35 together by force fitting, but this is not absolutely necessary, since, in the assembled position, the springs 12 press these parts against one another. Said springs 12 are accommodated in blind holes 11 of the extension piece. Each of them presses, on the one hand,

against the bottom of a hole 11 and, on the other hand,  
against a pusher rod 13 which also in part slides in  
said hole 11. This pusher rod 13 comprises, on its end  
which projects out from the hole, a hemispherical  
5 rounded portion 54, which is accommodated in a V-shaped  
trough 35 of a contact element 5. This trough 35  
articulates the element 5 to one of the median contact  
parts 2, 2', which comprises corresponding notches 32  
for this purpose. To ensure that said element 5 cannot  
10 move, it comprises a projection 55 on each side, which  
widens it.

As shown in Figure 2, each median contact part is  
formed by a tab 30 or 31, acting as terminal, extended  
15 by a support arm 27, 29. A linking bar 24, 25, bent at  
a right angle, starts from this arm and another arm 26,  
28 is bent at a right angle to this bar, such that the  
two arms are parallel and that the contact part has a  
U--shaped cross-section. The notches 32, in which the  
20 contact elements 5 are accommodated, are cut out from  
the two support arms 26, 27 and 28, 29 respectively.  
Another terminal 33, 34, respectively, starts from the  
linking bar 24, 25, initially in a straight line, then  
upwards inside the housing. This makes it possible to  
25 make another connection with a consumer device or with  
an electronic circuit, mounted for example in said  
housing 1.

Given that the switch is intended to provide a good  
30 switching action and in particular to be used for  
elevated levels of current, each of the contact  
elements 5 comprises on each side a contact 36 of  
silver or of another metal covered with silver. The  
contacts 37 of the side parts 3 and 4 are made in the  
35 same manner. These side contact parts, of which there  
are two, are mounted such that they may be cross-  
connected. Operation thereof will be explained below.  
Each of said parts 3 and 4 comprises a terminal 52, 53  
respectively, which projects beyond the lower part 48

of the housing and which is extended forming a plurality of bends 38, 39 respectively. The arrangement of these two side contact parts and their cooperation is illustrated in Figure 3.

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Both ends of the oblong pivoting part 8 bear journals 22 which engage in corresponding holes in the arm 23 of the housing. These arms 23 are integral with the lower part 48 of this housing and face one another on each side of this part. When the pivoting part is inserted between these two arms 23, the latter yield resiliently. Once said part has been set in place, force fitting of the lower part 48 in the walls 49 of the housing prevents said arms 23 from yielding again.

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A lever arm 9 is offset laterally, by successive bends, from the plane of the operating member 6 and of the pivoting part 8. At its end, this lever arm 9 is firmly connected to a control member 10 oriented at a right angle and sliding in a guide groove 15 of a switching bar 14. The latter can slide in the side walls of the housing, which is not shown in the figures. The groove 15 is cardioid in shape and of uniform depth throughout. The mode of operation of a cardioid-shaped guide is known. The groove 15 comprises an upper inversion segment 16, a lower inversion segment 17 and an elongate intermediate part 18. The spacing of the two parallel grooves of this intermediate part 18, the distance between the control member 10 and the axis of rotation of the pivoting part 8, and the angle made by the lever arm 9 with the plane of the operating member 6 essentially determine the amplitude of the pivoting movement of said member 6 and must agree with one another. Furthermore, the length of the intermediate part 18 and the speed of movement of the switching bar 14 determine the contact-making time between the median parts 2, 2' and the side parts 3, 4. In known, cardioid-shaped guides, this intermediate part is very short, because the two inversion sectors also represent

stable switching positions, for example closing-opening. The changeover from one switching position to the other must be as quick as possible, which means that this intermediate part must be made very short.

5 However, with the present configuration of the guide groove, it is the two inversion sectors 16, 17 which constitute the stable median position of the operating member 6 in which there is no electrical contact between the median parts 2, 2' and the side parts 3, 4.  
10 Contact is only made when the control member 10 is located in the grooves of the intermediate part 18. When the switching bar 14 is away from its median position, the control member 10 slides in these latter grooves. The contact elements cannot rock, because  
15 these two grooves are separated by the projecting part located between them. This part effects positive or forced guiding, which is maintained until the control member 10 has reached the upper inversion segment 16 or lower inversion segment 17. At this moment, the  
20 operating member 6 returns from the unstable switching position to the stable median position. If the contacts 36, 37 were to be welded by an excessively strong current, the chamfers 45 of the ends of the extension piece 7, which then rub on the V-shaped trough 35 of  
25 the contact element 5, would push this element back to its median position. To this end, the angle of said chamfers corresponds to that of the flanks of said trough.

30 The guide groove 15 also comprises, beyond the upper inversion segment 16, a longitudinal groove 19 oriented in accordance with the axis of the switching bar 14. Should the latter inadvertently be pressed too far downwards, the control member 10 would enter this  
35 groove 19. There would be no change in the median position of the operating member 6 and the switch would therefore be protected from damage. In a similar manner, beyond the lower inversion segment 17 there is also a longitudinal groove 20, which is however very

short because a limit stop, not shown, of the switching bar 14 prevents extraction of this bar by raising it. However, so that the control member may more readily be introduced into said groove 20, the latter comprises  
5 down to the bottom a funnel-shaped insertion passage 21.

It has already been indicated that the lower part 48 of the housing comprises an opening 43 for draining away  
10 any liquid which may possibly enter into this housing. The switching system is also protected by an inclined roof 41, which starts from one of the side walls 49 and the end of which is located very close to the switching bar 14. The liquid runs from this roof onto said bar  
15 14, until it reaches a drip gutter 40, which is located above the drain opening 43.

As shown in Figure 1, the switching system essentially made up of the contact elements 5, the median contact parts 2, 2' and the side contact parts 3, 4, is located  
20 on one and the same side of the plane which passes through the points of articulation of these elements 5 on the median parts 2, 2' and the pivot axis of the operating member 6, i.e. on the opposite side to the  
25 switching bar 14.

It goes without saying that various modifications may be made to the switch shown and described without going beyond the scope of the invention.

What is claimed is:

1. An electric switch comprising a housing, a stationary median contact part and at least two stationary side contact parts, a contact element which is articulated on a support of the median contact part and which is capable of rocking from a stable median position to an unstable position on one or the other side of said median position, and an operating member articulated on the housing, which carries a spring-loaded pusher rod and is capable of sliding in a recess of said operating member, the latter cooperating with the contact element in such a manner that said pusher rod tends to cause said element to return to its stable median position, wherein said switch comprises a switching bar (14) which is connected by a forced guide device to the operating member (6) so as to cause the contact element (5) to pivot while said bar is moving from its median position to one or the other of its working positions, depending on the direction of this movement.

2. The electric switch as claimed in claim 1, wherein a lever arm (9) bearing a control member (10) is firmly connected to the operating member (6), this control member (10) moving in a cardioid-shaped guide groove (15) of the switching bar (14).

3. The electric switch as claimed in claim 2, wherein the guide groove (15) comprises upper (16) and lower (17) inversion segments and an oblong intermediate part (18), the length of which determines, together with the speed of movement of the switching bar (14), the contact-making time between the median contact part (2, 2') and a side contact part (3, 4).

4. The electric switch as claimed in claim 3, wherein the guide groove (15) comprises, at at least one inflection point of the inversion sector (16, 17),

a longitudinal groove (19, 20) starting from this point and oriented in the direction of the longitudinal axis of the switching bar (14).

5        5.        The electric switch as claimed in claim 4, wherein the longitudinal groove (20) of the inflection point of the lower inversion segment (17) widens towards the end of the switching bar (14), forming a funnel-shaped insertion opening (21).

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6.        The electric switch as claimed in any one of the preceding claims, wherein the operating member (6) is articulated in arms (23) of the housing by journals (22) provided on its two sides.

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7.        The electric switch as claimed in any one of the preceding claims, wherein the lever arm (9) is offset laterally from the plane of the operating member (6).

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8.        The electric switch as claimed in any one of the preceding claims, wherein, on the inside of the housing, each median contact part (2, 2') is made up of a linking bar (24, 25) and two bearing arms (26, 27, 28, 29) substantially bent at a right angle in the same direction.

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9.        The electric switch as claimed in claim 8, wherein the bearing arms (26, 27, 28, 29) comprise notches (32) intended to accommodate the respective contact element (5).

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10.       The electric switch as claimed in any one of the preceding claims, wherein each median contact part (2, 2') comprises, in addition to its terminal (30, 31) which protrudes from the housing, another terminal (33, 34) arranged in said housing.

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11. The electric switch as claimed in any one of the preceding claims, wherein the contact element (5) comprises, on the side of its support, a V-shaped trough (35), into the hollow of which a spring presses  
5 the pusher rod (13), pushing said element (5) into the notches (32) of the support arms (26, 27, 28, 29).

12. The electric switch as claimed in any one of the preceding claims, wherein the switching system,  
10 essentially made up of two median contact parts (2, 2') and, for each one, of two side contact parts (3, 4) together with contact elements (5), is located on only one side of the plane which passes through the support of the corresponding contact element (5) and through  
15 the pivot axis of the operating member (6).

13. The electric switch as claimed in any one of the preceding claims, wherein the direction of movement of the switching bar (14) is substantially  
20 perpendicular to the pivot axis of the contact elements (5).

14. The electric switch as claimed in any one of the preceding claims, wherein it comprises in its  
25 housing two contact elements (5), with each of which cooperate two cross-connected side contact parts (3, 4).

15. The electric switch as claimed in claim 14,  
30 wherein each of the side contact parts (3, 4) is in one piece.

16. The electric switch as claimed in claim 15, wherein each of the side contact parts (3, 4) comprises  
35 at least one right-angled bend (38, 39).

17. The electric switch as claimed in any one of the preceding claims, wherein the switching bar (14) comprises a drip gutter (40) at its end.

18. The electric switch as claimed in any one of the preceding claims, wherein the switching system is covered by an inclined roof (41) connected to a side wall (49) of the housing and intended to protect said system from becoming dirty.

19. The electric switch as claimed in any one of the preceding claims, wherein the operating member (6) comprises, on each side of its end which faces the contact element (5), a chamfer (45), the angle of which substantially corresponds to that of the respective flank of the V-shaped trough (35) of said element (5).